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Title:
The Codimension of Pseudo-Plateau Bursting

Abstract:
A great deal of work has gone into classifying bursting oscillations, periodic alternations of spiking and quiescence modeled by fast-slow systems. In such systems, one or more slow variables carry the fast variables through a sequence of bifurcations that mediate transitions between oscillations and steady states. A rigorous classification approach is to characterize the bifurcations found in the neighborhood of a singularity; a measure of the complexity of the bursting oscillation is then given by the smallest codimension of the singularities near which it occurs. Fold/homoclinic bursting, along with most other burst types of interest, has been shown to occur near a singularity of codimension three by examining bifurcations of a cubic Lienard system; hence, these types of bursting have at most codimension three. Modeling and biological considerations suggest that fold/homoclinic bursting should be found near fold/subHopf bursting, a more recently identified burst type whose codimension has not been determined yet. One would expect that fold/subHopf bursting has the same codimension as fold/homoclinic bursting, because models of these two burst types have very similar underlying bifurcation diagrams. However, no codimension-three singularity is known that supports fold/subHopf bursting, which indicates that it may have codimension four. We identify a three-dimensional slice in a partial unfolding of a doubly-degenerate Bodganov-Takens point, and show that this codimension-four singularity gives rise to almost all known types of bursting.